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# Modern sector development: The role of exports and institutions in developing countries

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## Abstract

A prospering modern sector is crucial for the successful long-term development in developing countries as it provides income and job growth for large shares of society. While this idea is widely accepted, there is, perhaps surprisingly, far less analysis about the exact determinants of this economic modernization process. In this article we empirically investigate whether international trade and institutions, both much discussed in the debates on general growth and development, are particularly important for the diffusion of production in the modern sector within developing societies. In a large cross section time-series sample, we provide robust estimation results that point to an important role of institutions and to a nonlinear impact of manufacturing exports. Our results, which are derived using a range of estimators and are ultimately less susceptible to endogeneity concerns, also provide interesting insights into the role of natural resources and official development aid.

## KEYWORDS

developing countries, institutions, international trade, manufacturing growth, panel analysis

## JEL CLASSIFICATION

C23; O11; O14; F15

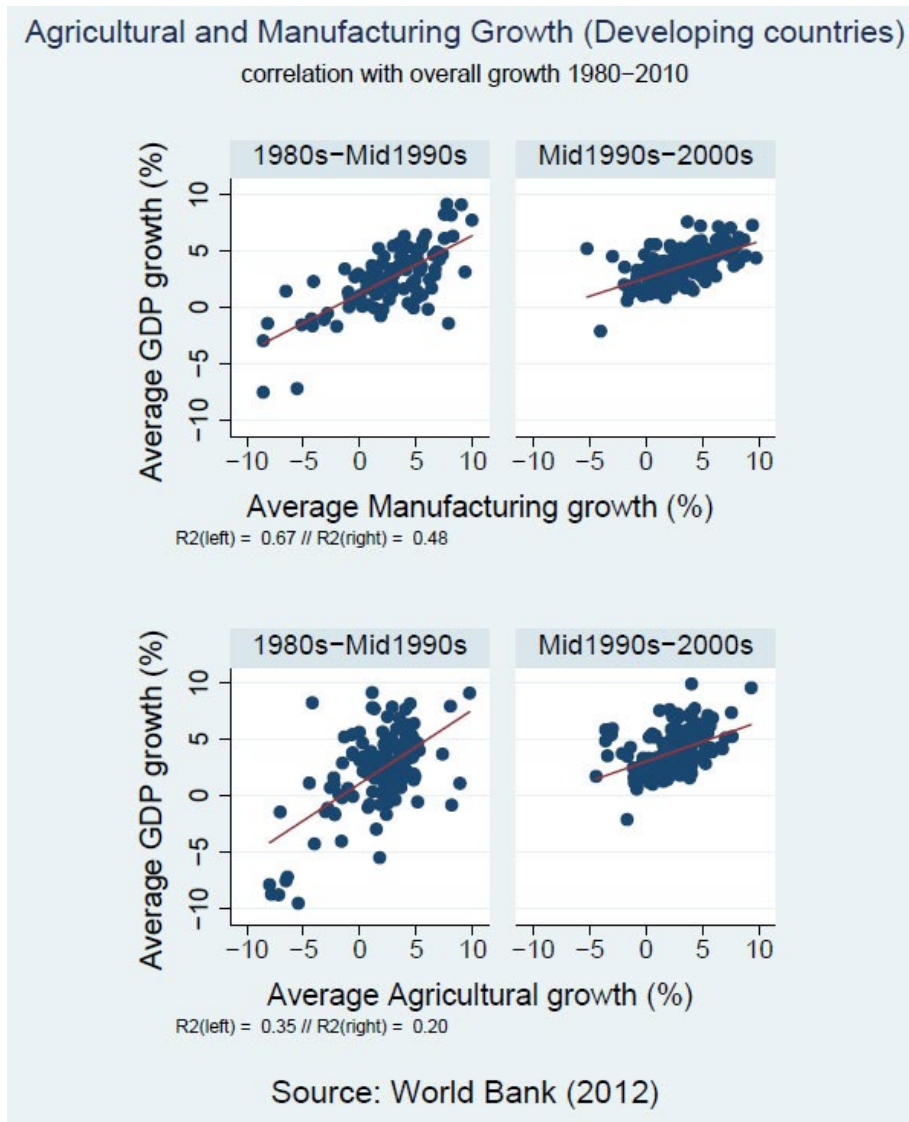
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## 1 | INTRODUCTION

A thriving modern sector is of major importance for a country's long-term and sustainable development. The historical experience of today's advanced economies suggests that the path to growth in these countries was accompanied by a structural shift toward a modern manufacturing sector. While Western countries already industrialized as early as the mid-19th century, newly industrialized countries such as South Korea or Taiwan massively expanded their manufacturing sectors in the mid- to late 20th century. Moreover, recently we have been witnessing the emergence of a strong Chinese manufacturing sector that drives the overall economic performance of the whole country. In addition to such anecdotal evidence, recent research by Rodrik (2013) on labor productivity in manufacturing underlines the importance of understanding the mechanisms that drive development in the modern, in particular, the manufacturing, sector.<sup>1</sup>

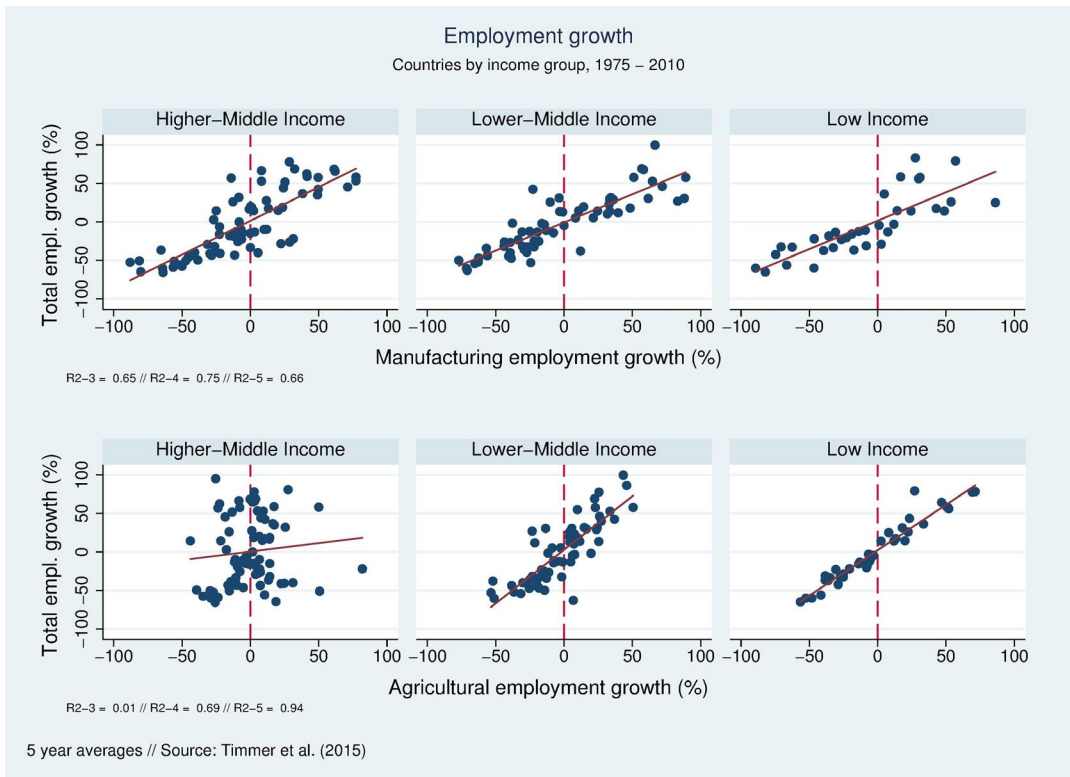
In the literature, a number of empirical and theoretical studies emphasize the importance of a modern sector for overall economic performance. While some contributions (e.g., De Vries, Erumban, Timmer, & Voskoboynikov, 2012; Peneder, 2003; Rodrik, 2009; Szirmai, 2012; Timmer & De Vries, 2009) empirically document the positive impacts of the dynamics of the modern sector on the overall economic development,<sup>2</sup> others suggest, by using an analytical framework, that there are links between sectoral and general productivity or development (e.g., Duarte & Restuccia, 2010; Dekle & Vandenbroucke, 2012; Kuralbayeva & Stefanski, 2013). Figure 1 illustrates the correlation between overall and sectoral growth using data from the sample examined in this study. We map growth rates of the manufacturing sector (upper panel) and growth rates of GDP in developing countries over two time periods between 1980 and 2010. In comparison we relate growth rates of the agricultural sector (lower panel) and growth rates of GDP. While both sectors appear to be positively correlated with per-capita GDP growth, there is a clear relatively stronger association of the modern sector in these countries. Figure 2 illustrates how important a focus is on the modern manufacturing sector. By using data from the 10-sector database, we relate overall employment growth with sectoral employment growth by income group. Again the top panel shows figures for the manufacturing sector, whereas the bottom panel shows figures for the agricultural sector. While the relation between manufacturing employment growth and the overall employment growth is stable across income groups, this does not hold true for agricultural sector employment growth for the higher-income group. In other words, the opportunity to further enjoy employment growth becomes more viable with the manufacturing sector than with the agricultural sector after a certain level of income and development is reached.

However, although the positive relationship between manufacturing activities and the overall growth achieves consensus among economists, naturally the question arises as to what exactly makes a country's (modern) manufacturing sector grow. What drives the economic dynamics in this important sector? Surprisingly, there is little evidence provided in the literature and, to the best of our knowledge, no comprehensive empirical estimation of a modern sector's development drivers. A possible reason may be that the literature about structural change has received considerable attention lately and focused on descriptions and benefits. For example, Fagerberg (2000) shows that structural change occurs when within manufacturing economies focus on the technologically most progressive subsectors. This lets manufacturing sector's productivity grow faster. Similarly, Peneder (2003) shows that greater shares in high-tech industries positively influence income growth. In addition, explicitly for developing regions, McMillan and Rodrik (2011) show that structural change is conducive to development if labor shifts to higher-productivity sectors.<sup>3</sup> Our question of driving factors is connected to the literature that documents the importance of structural change but is still distinctly different. While we take the sector's importance for long-run development<sup>4</sup> as given (as thoroughly argued), we ask what promotes this sector and thus what are the determinants to modernize the economy by



**FIGURE 1** Association between sectoral and overall growth in developing countries, 1980–2010  
Source: World Bank (2012). [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

manufacturing expansion. In other words, we will explore direct growth determinants for this sector and do so along the lines of the existing (overall) growth literature. Herrendorf, Rogerson, and Valentinyi (2014) review a large body of literature mostly of theoretical advances in the structural change and find that most times exogenously given changes are considered to be impacting on the process of structural transformation. Though we are not directly concerned with an economy's relative compositional structure, we depart from the suggestion of Herrendorf et al. (2014) and ask for the factors behind the evolution of modern sectors, the drivers. The literature on structural change that incorporates internationalization is narrow; in particular, more recent studies are not at all numerous. Matsuyama (2009) proposes an open economy model for structural change including a trade channel



**FIGURE 2** Employment growth, sectoral and overall

Source: Timmer et al. (2015). [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

that may positively impact on the employment share of the manufacturing sector. More quantitatively this idea is supported in Uy, Yi, and Zhang (2013) for the experience of South Korean manufacturing.

Therefore, in this paper we adopt a somewhat broader view. We take the growth of the manufacturing sector as a broader indication for the economic modernization process in a developing country. We ask, to what extent does a developing country's society have access to income generation in the modern sector and what are the determinants of this economic modernization process? In other words, we are interested in the diffusion of production in the modern sector within the society. We indicate access to income generation in the modern sector by the value-added per capita of the manufacturing sector. As this measure describes modern production per capita, it may be interpreted as an indicator for the spread of modern economic activities within a country's population. Our modern sector perspective shall capture its role in the long-run development and the sector as a source to provide fundamental societal and economic change on a potential path toward higher stages of development and income. With interest in pinning down potential determinants of this modernization, we focus on the role of exports and institutions for the development of this important subsector.

Why is the manufacturing sector expected to promote growth and, in particular, eligible to be associated with trade and institutions? The answer, we argue, lies, on the one hand, in its special characteristics and, on the other hand, in the mechanisms that connect trade and institutions with development in the general growth literature. Szirmai (2012) thoroughly reviews the key characteristics (that also make the sector especially relevant for the overall growth). First, the sector is said to provide better opportunities for capital accumulation, which is a crucial factor for growth. Typically, capital intensity

is higher, and manufacturing is more concentrated than spatially dispersed agriculture. Second, the manufacturing sector evokes higher productivity increases, a mechanism that has also been referred to as the structural change bonus (Rodrik, 2009; Temple & Woessmann, 2006; Timmer & De Vries, 2009). Apart from opportunities for economies of scale, linkage and spillover effects are important aspects of the modern manufacturing sector. The linkage effect refers to a situation where direct forward and backward interactions (linkages) between different (sub) sectors occur and present positive externalities to investment. Spillover effects are special externalities to investments in knowledge and technology and occur both within and across sectors.

Our proposition, namely, that exports impact on the development of the modern sector, is guided by the trade literature on the impacts of *manufacturing exports* on the overall development (e.g., Berg, Ostry, & Zettelmeyer, 2012; Herzer & Nowak-Lehmann, 2006; Herzer, Nowak-Lehmann, & Siliverstovs, 2006; Hesse, 2008; Imbs & Wacziarg, 2003; Lederman & Maloney, 2003; Naudé, Bosker, & Matthee, 2010). While the literature on general trade and development remains rather inconclusive,<sup>5</sup> the line of argumentation in the mentioned strand suggests that a vertical diversification of exports, that is, manufacturing in addition to primary products, is beneficial (Berg et al., 2012; Herzer & Nowak-Lehmann, 2006) because it alleviates (export) price instabilities for primary products (Hesse, 2008). This suggestion is also supported by Lederman and Maloney (2003), who find that an export sector that concentrates on natural resources has a rather negative impact on growth. Further, the benefits of the exports of and diversification toward manufacturing products include (1) (firm-level and industry-wide) productivity and efficiency gains (Dogan, Wong, & Yap, 2011; Herzer et al., 2006; Melitz, 2003; Naudé et al., 2010), (2) (knowledge) spillovers and diffusion (Herzer et al., 2006; Naudé et al., 2010), and (3) the loosening of a country's foreign exchange constraint (Naudé et al., 2010). We argue that the benefits of vertical diversification vis-à-vis traditional primary production<sup>6</sup> are channeled through the manufacturing sector with the special characteristics outlined earlier, and naturally most of these effects will primarily have an impact on the modern manufacturing sector. Some empirical evidence for the beneficial channel of trade is presented in Chandran and Munusamy (2009) for the case of Malaysian manufacturing.

Similar to trade or, more precisely, exports, institutions may well prove to be a determinant of the dynamics of the manufacturing sector. The broad discussion of the impact of institutions on growth dates back to North (1990) and has spawned influential research that argues that it is relevant (e.g., Acemoglu, Johnson, & Robinson, 2005; Rodrik, Subramanian, & Trebbi, 2002). Thus, if institutions matter in the hypothesized way to the aggregate economy, they are expected to be all the more important to the development of the modern sector. As the concept of institutions is highly complex, we highlight only some of the aspects in this article. A much-discussed institution highly relevant to our analysis is property rights. Acemoglu, Johnson, and Robinson (2001) focus on expropriation risk as a dimension of the enforcement of property rights and find that this has a strong impact on per-capita income development. When it comes to the modern sector, we consider this risk important as the manufacturing sector is characterized by higher capital needs, so uncertain property rights (in this case, expropriation risk) can consequently hamper investment. A second dimension of property rights that is presumably important to the modern sector is the availability of contractual enforcement institutions. Focusing on the environment of firms, Johnson, McMillan, and Woodruff (2002) find, without differentiating any further, that weak property rights prevent firms from investing their profits.

In our panel analysis of a sample of 75 developing countries from 1970 through 2005 we find evidence of the importance of both manufacturing exports and institutional quality for the growth of the manufacturing sector. These findings are robust across model specifications and different estimation strategies. While we are also able to underline the importance of secure property rights as an economic

institution, we are unable to conclude that manufacturing exports are equally important across all income levels. The remainder of the paper is structured as follows. The next section contains our empirical analysis with an in-depth description of model, estimation strategy, and data, followed by a section that discusses results, including tables. The last section concludes.

## 2 | EMPIRICAL ANALYSIS

In this section we map out the econometric model and explain our dataset. We are particularly interested in whether exports and institutions drive the development of the manufacturing sector. Based on the literature referenced earlier, we hope that it is possible to establish this link empirically. Our estimations are based on a generalized method of moments (GMM) estimator that explicitly accounts for endogeneity among the regressors as well as country-specific effects. However, we also use several other estimators to review the robustness of our primary results. In the following text, we motivate the model and the estimation technique and discuss several of the common estimators in growth estimations.

### 2.1 | Model and methodology

We analyze a panel of 75 developing countries<sup>7</sup> over the period 1970–2005, which is split into six nonoverlapping 5-year intervals. Since we wish to identify the drivers of growth in the manufacturing sector, we estimate the model as follows:

$$y_{it}^m - y_{i(t-1)}^m = gr_{it}^m = \alpha + \beta y_{i(t-1)}^m + \gamma \text{Exp}_{it}^m + \delta \text{Inst}_{it} + \theta \text{Cont}_{it} + \xi_t + \eta_i + \varepsilon_{it} \quad (1)$$

where the subscripts  $i$  and  $t$  denote country and time, respectively;  $y^m$  is manufacturing output in logarithmic form,  $\text{Exp}^m$  and  $\text{Inst}$  represent the regressors of interest, exports in manufacturing and institutions, respectively, whereas  $\text{Cont}$  is a varying set of control variables.  $\xi$  and  $\eta$  are unobserved period- and country-specific effects,  $\alpha$  is a common intercept, and  $\varepsilon$  is an i.i.d. error term. In our half-decade panel, we average most variables over the time period. This removes short cycles that are not of interest here and therefore displays the relationship of the variables within 5 years. We hypothesize that the time frame is well chosen to capture the effects of our independent variables on our dependent one; that is, we expect the effects to materialize within 5 years. However, even though averaging the variables is commonly conducted and necessary, it comes at the cost of reducing sample size and losing variation. The lagged term of  $y^m$  captures the convergence present in manufacturing as found by Rodrik (2013) and is the beginning-of-period value of the dependent variable. For example, we regress the growth rate of manufacturing output between 1990 and 1995 not only on the control variables averaged over the same time period but also on the initial value of manufacturing output in 1990. The panel specification enables us to include  $\eta_i$ , a control for unobserved country-inherent and time-invariant effects. These effects may otherwise be a source of endogeneity from omitted variables. We are therefore able to control for characteristics including geographical and population features such as natural resources, colonial history, climate, and remoteness. Di Giovanni and Levchenko (2009) even argue that the institutional quality and the political system can be captured. The time effects we control for ( $\xi$ ) pick up shocks common to the whole system, for example, world market fluctuations.

However, if rewritten, Equation 1 represents a classic dynamic model with a lagged dependent variable

$$y_{it}^m = \alpha + (1 + \beta)y_{i(t-1)}^m + \gamma \text{Exp}_{it}^m + \delta \text{Inst}_{it} + \theta \text{Cont}_{it} + \xi_t + \eta_i + \varepsilon_{it} \quad (2)$$

that introduces known estimation problems. The inclusion of  $\eta_i$  is especially problematic for the conventional OLS estimator. For consistency, the country-specific effects would have to be orthogonal to other regressors (Caselli, Esquivel, & Lefort, 1996), a feature that must be ruled out due to the presence of a lagged dependent variable.

A prominent approach is to use a class of estimators, which first start by eliminating the country-specific term by either taking deviations from period averages and focusing on within-country variation (fixed-effects or least squares dummy variable [LSDV] estimator) or using period averages right away (between estimators) (DeJong & Ripoll, 2006). The former has been found to be consistent only for a large time dimension, a feature that most macroeconomic panels, including ours, lack. However, as the bias is well known (Nickell, 1981), bias-correcting estimators have been developed for small T panels (e.g., Kiviet, 1995, or for unbalanced panels, Bruno, 2005). Even though the latter estimator already deals successfully with this bias, it still requires, as does the fixed-effects estimator, strictly exogenous regressors.<sup>8</sup> If this is not given, there is a lasting contemporaneous correlation between regressors and disturbances that aggravates the estimation (Caselli et al., 1996). We must acknowledge that imposing the strict exogeneity restriction on our regressors would be highly critical because when it comes to our two variables of interest, exports and institutions, one can convincingly argue that they are not only causes but also effects of manufacturing development. For example, the firm-level literature on exports often argues that more productive companies may select themselves into the export market, which would also mean a reverse causality in the aggregate case, or that exports enhance a company's productivity through exposition to international competition or economies of scale.<sup>9</sup> The latter is the channel explored in this research. However, as we only want to capture the channel from exports to sectoral growth, we must best avoid the potential source of the endogeneity bias.

An often-used solution for this problem is to use the system GMM estimator proposed by Arellano and Bover (1995) and Blundell and Bond (1998). The system GMM estimator is similar to the difference GMM estimator proposed by Arellano and Bond (1991). Both estimators use a differenced version of Equation 1

$$\begin{aligned} gr_{it}^m - gr_{i(t-1)}^m &= (\alpha - \alpha) + \beta(y_{i(t-1)}^m - y_{i(t-2)}^m) + \gamma(\text{Exp}_{it}^m - \text{Exp}_{i(t-1)}^m) \\ &\quad + \delta(\text{Inst}_{it} - \text{Inst}_{i(t-1)}) + \theta(\text{Cont}_{it} - \text{Cont}_{i(t-1)}) \\ &\quad + (\xi_t - \xi_{t-1}) + (\eta_i - \eta_i) + (\varepsilon_{it} - \varepsilon_{i(t-1)}) \end{aligned} \quad (3)$$

to eliminate the country-fixed effect  $\eta_i$ . Endogeneity concerns associated with the regressors are circumvented by using within-instruments. In our model, it is particularly important to account for the potential endogeneity problem for two reasons. First, both variables of interest, institutions and exports, can be determined by manufacturing development. Second, the included control variables may flaw the estimation if they are not exogenous. The use of within-instruments, that is, the use of instruments from the available data, is an appealing approach since we would struggle to find convincing instruments from outside. Under two assumptions, we may find internal instruments for the first-differenced equation: (1) the error  $\varepsilon_{it}$  is not serially correlated and (2) the variables in levels are weakly exogenous, that is, potentially correlated with past (and current) disturbances but not with future errors. Under these conditions, lagged levels may prove to be valid instruments for their first differences. However, Easterly and Levine (2001) note that lagged levels of persistent regressors may prove to be weak instruments in Equation 3



and bias the estimation. Further, the sole use of differences leaves information about the level relationship unused (DeJong & Ripoll, 2006) and reduces the time dimension of the sample. Especially the latter fact is critical as our time dimension is already short ( $T = 6$ ). To circumvent the arising problems, the system GMM estimator has been introduced to combine the first-difference equation 3 with the level equation 1. To obtain lagged first differences as valid instruments in the levels equation, a further assumption must be made: first differences may not be correlated with the country-fixed effect.

Even though this estimator controls for many caveats in the dynamic panel data estimation, it hinges on assumptions that need to be validated. We follow Roodman (2006) and report next to regression coefficients and the sample-size various test statistics which are designed to validate the identifying assumptions. These include the Hansen's J-test for overidentification (Hansen, 1982) and Arellano and Bond's (1991) tests for autocorrelation. The Hansen test's null hypothesis is that the instruments are exogenous and therefore should not be rejected. As this test may be weakened by instrument proliferation (Roodman, 2009), we limit the number of instruments<sup>10</sup> and report their count. Next, we report the  $m_1$ - and  $m_2$ -tests for autocorrelation in the differenced errors ( $\varepsilon_{it} - \varepsilon_{i(t-1)}$ ). The presence of the second-order serial correlation (in differenced errors) implies first-order serial correlation of the  $\varepsilon_{it}$ , which violates our assumptions. Therefore, we should not reject the null of no serial correlation in the  $m_2$ -test. Further, we explore not only the exogeneity of the complete set of instruments but also that of specific subsets. As noted in Roodman (2009), a specific subset of interest are the lagged differences as instruments for the lagged dependent variable (in the levels equation). We report a  $p$ -value for the difference-in-Hansen test of the null hypothesis of instrument exogeneity.<sup>11</sup> And, lastly, we use the finite-sample Windmeijer (2005) correction and the two-step estimator to deal with heteroscedasticity and arbitrary correlation patterns within countries.

Our strategy involves running several specifications with a differing set of control variables and using several different estimators. However, as outlined earlier, we obtain most results from our preferred system GMM estimator.

## 2.2 | Data and variables

To obtain a large set of panel data with the regressors of interest and relevant controls, we combine several data sources. These include the World Bank's development indicators, Barro and Lee's educational attainment dataset, the comtrade dataset on exports by category (UN Comtrade 2012), the Penn World Tables (Feenstra, Inklaar, & Timmer, 2015), the Fraser Institute's World Freedom Index (Fraser Institute, 2012), and the International Country Risk Guide (ICRG). The countries in the sample are selected solely based on data availability and the World Bank's income classification. We include developing countries that are associated with income group three, four, or five.<sup>12</sup> Summary statistics are given in Table A1 (Appendix).

### 2.2.1 | Dependent variable

Our dependent variable is the growth rate, averaged over 5 years, of per-capita manufacturing output. In analogy to common empirical growth estimations, we relate output to population, as this accounts for size effects between economies and enables us to interpret them as the population's penetration with the production of the modern sector. Related measures are the relative share of a sector in GDP or the sectoral labor force's productivity. While the former targets relative changes, the latter targets a specific growth channel. Even though our focus is on neither of them, we make sure that our results

are not contradictive.<sup>13</sup> Manufacturing output is taken as value added in constant 2000 US\$ from the World Bank's development indicators (World Bank, 2012), whereas the population figures are from the Penn World Tables version 7.1 (Heston, Summers, & Aten, 2012).

### 2.2.2 | Independent variables

Our subject of interest is the effect of exports and institutions on the dynamics of the manufacturing sector. First, we use manufacturing exports from the United Nations Commodity Trade Statistics database (Comtrade, 2012). Manufacturing comprises products in SITC categories 5 to 8. Again, we relate manufacturing exports to population figures to account for size effects and to achieve comparability across countries. Next, the Fraser Institute's Economic Freedom Index (Gwartney, Lawson, & Hall, 2012) serves as an approximation of institutional quality. It is scaled from 1 to 10, with 10 being the best-developed institutions across several dimensions, including the size of the government; legal structure and property rights; access to money; freedom to trade; and regulation of credit, labor, and business. The index is often used in the literature, not least because it provides a long series of data and is therefore suitable for the panel analysis we perform with a time dimension of over 30 years.

### 2.2.3 | Control variables

We expect the amount of human capital available to impact the growth of a more modern sector. In developing countries, manufacturing activities (in comparison to, e.g., subsistence agriculture) generally require the use of more complex technology, which in turn can be put to productive use only by an educated workforce. The absorption of better technology should therefore be facilitated by a more highly educated workforce. To approximate the level of human capital, we mainly use average years of schooling of both men and women. The data source is Barro and Lee's educational attainment dataset (2010). Another common determinant of growth is investments. Especially for a capital-intensive modern manufacturing sector, investments appear invaluable. We also include investments in our regression to comply with standard empirical growth estimations (e.g., Mankiw, Romer, & Weil, 1992).

Next, foreign aid is also believed to impact especially on the manufacturing sector. Rajan and Subramanian (2011) conduct an empirical investigation of this. According to them, aid favors the domestic non-tradables sector over an export manufacturing sector in that it affects the real exchange rate. Empirically, they find that recipient countries perform worse in terms of their manufacturing sector's share in GDP. We control for the impact of aid on manufacturing in our estimations, using aid data from the World Bank (World Bank, 2012). We also use official per-capita information on development aid and assistance.

Further, we include urbanization, which can be regarded as a driver of the development of the modern sector in three ways. First, urban agglomerations provide easy access to a pool of labor that can be employed in manufacturing. Second, geographical closeness facilitates spillover effects. Third, urbanization can also be regarded as a measure of modernization, in general (health, education, and infrastructure). However, because urbanization can also be easily thought of as an effect rather than a cause, it is important to treat it as a potentially endogenous variable.

And, lastly, dependence on natural resources may also influence the development of the modern sector and is therefore included. Several channels are suggested in the related literature (see, e.g., van der Ploeg, 2011). First, resource availability may divert funds away from more beneficial activities, of which the modern sector is certainly one. Second, triggering conflicts over rents, dependence on

resources also increases uncertainty, which can negatively affect real investments and human capital accumulation. Third, a boom in natural resource exports can drive up the exchange rate and decrease the competitiveness of the manufacturing sector. For these reasons, we let dependence on natural resources enter our model. However, as the effects potentially depend on the institutional environment, we do not necessarily expect a strong impact in either direction. The data are drawn from the World Development Indicators (World Bank, 2012) and represent resource rents as a share of GDP, and separately their subcomponents, oil, gas, coal, mineral, and forest rents, as shares of GDP.

As mentioned in the Introduction, recent research by Rodrik (2013) analyzes convergence in labor productivity of the manufacturing sector. He finds unconditional convergence for both two-digit categories and aggregate manufacturing activities, which leads us to also account for conditional convergence across countries. We take the proposition of convergence as a point of departure to derive additional driving mechanisms. Thus, we set up a base case with conditional convergence and add our proposed influencing mechanisms, namely, exports and institutions. Technically, that means we control for  $\beta$ -convergence by including the lagged level of the dependent variable as a regressor. In our estimation we include the beginning-of-period level of per-capita manufacturing output as an explanatory variable for the growth rate.

### 3 | RESULTS

#### 3.1 | Exports and institutions

Table 1 shows our estimation result for the first set of estimations. This set employs the strategy of estimating *different* model specifications with the *same* estimator, our preferred system GMM estimator. Later we turn to alternative ways of estimation. Column (1) shows the basic estimations of the effects of our regressors of interest. Both variables, exports and institutions, display an impact on growth in the manufacturing sector, which is positive and significant alongside controls of convergence and time- and country-specific effects. The next column includes controls for effects other than country, time, and convergence. We include a control for human capital and official development assistance (column [2]) and also for urbanization and investments (column [3]). In columns (4) and (5), we present the estimations with an included control for natural resource rents (4) and the subcomponent, mineral rents (5).<sup>14</sup> Even though the inclusion of further controls reduces the magnitude of the main effects, they clearly remain significant at the 1% level. Further, including additional regressors forces us only slightly to reduce the sample for data availability reasons alone. However, this slight reduction in the sample size (from 292 observations in column [1] to 279 observations in columns [2]–[5] in Table 1) does not change our estimation results.

Given that the system GMM estimator rests on restrictive assumptions, we discuss our instrument's validity based on common diagnostics. Almost all our estimations fulfill the required assumption about no serial correlation in the errors. According to the  $m_2$ -test we cannot reject the hypothesis of no second-order serial correlation (in the differenced errors). Further, as the consistency of the estimator critically hinges on the validity of the used instruments, we conclude from the J-test confirmation that our set of instruments is valid in the estimation. In other words, the null hypothesis of exogenous instruments cannot be rejected. Finally, we test for the validity of instrument subsets; that is, we test whether the instruments for each endogenous regressor qualify separately as valid. The results indicate that this is the case for almost all subsets.

Having established the impact of exports and institutions positively on the growth rate of manufacturing, with a presumably well-qualified estimator for dynamic panel data models, we turn to

**TABLE 1** Manufacturing Growth in Developing Countries - System GMM Estimates

Dependent: Manufacturing growth	All countries				
	(1)	(2)	(3)	(4)	(5)
Initial manufacturing <sub><i>t</i>-1</sub>	-0.298*** (0.055)	-0.243*** (0.074)	-0.221*** (0.049)	-0.218*** (0.052)	-0.201*** (0.056)
Manuf. exports <sub><i>t</i></sub>	0.184*** (0.041)	0.127*** (0.035)	0.124*** (0.039)	0.114*** (0.039)	0.119*** (0.039)
Institutions <sub><i>t</i></sub>	0.111*** (0.027)	0.104*** (0.037)	0.085*** (0.022)	0.089*** (0.023)	0.079*** (0.022)
Schooling <sub><i>t</i></sub>		0.016 (0.025)	-0.023 (0.022)	-0.016 (0.022)	-0.016 (0.018)
Urbanization <sub><i>t</i></sub>			0.002 (0.003)	0.001 (0.003)	0.001 (0.002)
Investments <sub><i>t</i></sub>			0.085* (0.049)	0.093* (0.053)	0.069 (0.051)
ODA <sub><i>t</i></sub>		-0.064** (0.031)	-0.040** (0.020)	-0.047*** (0.016)	-0.035* (0.019)
Natural res. rents <sub><i>t</i></sub>				0.003 (0.002)	
Mineral res. rents <sub><i>t</i></sub>					-0.015*** (004)
Implied $\lambda$	0.071	0.056	0.050	0.049	0.045
Observations	292	279	279	279	279
Countries	75	71	71	71	71
Hansen ( <i>p</i> -value)	0.62	0.36	0.56	0.52	0.46
Diff-in-Hansen ( <i>p</i> -value)	0.65	0.50	0.91	0.86	0.79
Instruments	54	56	68	69	69
AR(1) ( <i>p</i> -value)	0.00	0.00	0.00	0.00	0.00
AR(2) ( <i>p</i> -value)	0.35	0.28	0.32	0.32	0.40

*Notes:* Dependent variable in all models is per capita manufacturing growth. Initial manufacturing, manufacturing exports, investments, and ODA are used in per capita terms and natural logarithms. Natural and mineral resource rents are shares of GDP. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively. Windmeijer corrected S.E.s in parentheses. All models are estimated with constant, time- and country-fixed effects. Sample range is 1970–2005 in 5-year averaged non-overlapping periods. Diff-in-Hansen test tests the instrument exogeneity of the first-differences in the system-GMM levels equation (see text).

estimating the full specification (i.e., specification [5] in Table 1) with alternative estimators. While column (1) in Table 2 replicates the estimated coefficients in Table 1, columns (2)–(5) represent the estimations with the difference GMM estimator (2), the LSDVC estimator (3), and the fixed-effects estimator (4).

The estimated coefficients for exports are positive and significant across the various estimators. Their magnitude is greatest among the GMM estimations; however, significance is given at the 1%

**TABLE 2** Manufacturing growth in developing countries—different estimators

Dependent: Manufacturing growth	All countries			
	(1)	(2)	(3)	(4)
Estimator	SysGMM	DiffGMM	LSDVC	FE
Initial manufacturing <sub><i>t-1</i></sub>	-0.201*** (0.056)	-0.596*** (0.147)	0.763*** (0.055)	-0.422*** (0.048)
Manuf. exports <sub><i>t</i></sub>	0.119*** (0.039)	0.198*** (0.071)	0.062*** (0.021)	0.092*** (0.028)
Institutions <sub><i>t</i></sub>	0.079*** (0.022)	0.016 (0.053)	0.057*** (0.020)	0.043** (0.018)
Schooling <sub><i>t</i></sub>	-0.016 (0.018)	0.042 (0.061)	-0.005 (0.036)	0.008 (0.040)
Urbanization <sub><i>t</i></sub>	0.001 (0.002)	-0.040*** (0.014)	-0.005 (0.005)	-0.003 (0.004)
Investments <sub><i>t</i></sub>	0.069 (0.051)	0.061 (0.170)	0.131** (0.053)	0.195*** (0.048)
ODA <sub><i>t</i></sub>	-0.035* (0.019)	-0.007 (0.032)	0.012 (0.026)	0.012 (0.027)
Mineral res. rents <sub><i>t</i></sub>	-0.015*** (0.004)	-0.006 (0.010)	-0.010 (0.012)	-0.006 (0.009)
Implied $\lambda$	0.045	0.181	0.054	0.110
Observations	279	201	279	279
Countries	71	61	71	71
Hansen ( <i>p</i> -value)	0.46	0.64		
Diff-in-Hansen ( <i>p</i> -value)	0.79			
Instruments	69	37		
AR(1) ( <i>p</i> -value)	0.00	0.20		
AR(2) ( <i>p</i> -value)	0.40	0.81		

Notes: (see Table 1) Except the LSDVC model's dependent variable is the level of per capita manufacturing. \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively.

level across the board. The results for the institutions variable differ slightly. The obtained results are positive and significant (as the main estimation) in three of the four cases.

### 3.1.1 | Control variables

From the broad (theoretical) literature, we would expect *human capital* to enhance the growth of the modern sector, for example, as it facilitates the absorption of modern technology. However, looking at our estimations, we find mixed evidence of a positive impact of the level of human capital on the growth of the modern sector.<sup>15</sup> Even though it is oftentimes positive, in no estimation does the variable significantly support the development of the modern sector. We measure human capital in average

years of schooling. As summarized in Glewwe (2002), the link between schooling and productivity may not hold in all cases, especially not in sub-Saharan Africa. That the links from schooling to skills to productivity are not adequately given may explain our results.<sup>16</sup>

Next, we find that *investments* are positively related to manufacturing development. In most of our estimations, we find a significant effect and thus support for the standard proposition that higher investment levels support growth. This is expected, as manufacturing is, on average, more capital intensive than basic agricultural activities.

By contrast, we do not find much evidence that *urbanization* significantly supports manufacturing growth. In other words, we can assume neither that a functioning link exists between a prospective labor pool and the sector's activity nor that a more modern environment has a positive impact. This result may be due to the broad measure which urbanization is, or it may be due to the idea that we may be dealing with different types of urbanization as proposed by Gollin, Lagakos, and Waugh (2013). One fuels industrialization by supplying labor to the modern sector, whereas the other is based on the consumption of, for example, resource rents where people engage in low-productivity petty services instead of high-productivity industry jobs.

And, next, we find evidence of a negative impact of *official development aid* on manufacturing growth. While the effect is smaller in magnitude than our main effects, trade and institutions, we can argue that official development aid is by no means a driver of structural change as it impedes the development of the modern sector. The proposed link via the real exchange rate (Rajan & Subramanian, 2011) may, therefore, indeed put the manufacturing (tradable) sector at a disadvantage compared to other sectors. However, very likely it may also be the case that aid, by flowing into other sectors (health and education), makes the modern one less competitive in comparison.

In the last two columns of Table 1 we present the results of natural resources as a factor that impacts on the development of the modern sector in our sample. The broad literature on the dependence of natural resources proposes several channels, which are in short outlined earlier.<sup>17</sup> In column (4) we include the dependence of natural resources in our model and note two aspects. First, our results hold, lending further credibility to our specification. And, second, which is almost equally interesting and important, we see no significant impact of natural resources on the development of the modern sector. However, from this estimation we can only infer that natural resources do not impede the development of the modern sector controlling for institutions, exports, and human capital. All of these are major channels of impact described in the natural resource literature. Another reason could be that the subcomponents of natural resources (i.e., gas, oil, coal, minerals, and forests) show different effects and therefore lead to a non-significant overall effect. We consider this second explanation and report the most interesting result in column (5) of Table 1. For the minerals subcomponent, we find a significant negative effect, even though we still control for the main channels of impact. We assume mineral extraction in developing countries to have comparatively higher labor intensity, especially in sub-Saharan Africa. This may present a further constraint to the development of the modern sector as some labor force may be absorbed by mineral mines. In various cases mines produce with high labor intensity, and the modern sector may compete with the extraction sector for a similar kind of labor. Our results suggest that even though, in general, natural resources may not be problematic or even a curse, individual resources may differ in their impact on the development of the modern sector, as the example of minerals shows in our estimation.

### 3.1.2 | Convergence

Our estimation results indicate that there is conditional convergence in the aggregate per-capita manufacturing output growth. Countries with a lower prior level of manufacturing output therefore grow

faster, as indicated by the negative coefficients on the initial manufacturing output in Tables 1 and 2. The convergence effect is significant across all estimations. Our estimation is thus in line with the proposition of Rodrik (2013) concerning the existence of convergence in the labor productivity of the manufacturing sector, although in our case it is conditional upon the set of control variables and not restricted to the labor force. Nevertheless, our conditional convergence effects are similar in magnitude to the ones estimated on labor productivity. To illustrate this, we report the implied  $\lambda$ , which is the annualized rate of convergence derived from the coefficient for our lagged dependent variable.  $\lambda$  solves  $1 + \beta = e^{-\lambda t}$ , with  $\beta$  being the estimated coefficient and  $t$  the time in years between the current value and the lagged term, in this case  $t = 5$ .<sup>18</sup> The annualized rate of convergence in manufacturing is estimated at around 5% a year, whereas Rodrik's conditional estimations vary between 5% and 6%.<sup>19</sup> Finally, from an econometric point of view, we gain confidence that we model and specify correctly by comparing the estimates of the fixed-effects and system GMM estimations.

### 3.2 | Extension

Having established the relevance of both institutions and trade for the growth of the modern sector, we extend the estimations to improve and strengthen the results along two lines, namely, a differentiation of institutions and trade effects across income levels.

First, in the main analysis, we use the broad measure of economic freedom from the Fraser Institute. As the index is also available in subcategories, namely, the size of government, legal structure and property rights, access to money, freedom to trade, and regulation of credit, labor, and business, we can also use these to approximate the quality of economic institutions more precisely (assuming that the index components are obtained in an unbiased and comprehensive manner). The approach is an endeavor to pin down more precise effects, if possible. However, we aim to relate the various options to the literature and use guidance from theory. First we exclude the subcomponent "size of government" of the institutional quality index. We do so to avoid relying on an indicator that is frequently criticized for being ideologically skewed. A bigger "size of government" generally reduces the institutional quality score, a procedure that may be regarded as questionable (column [1], Table 3).

Next, we reduce the index to legal structure and property rights and the regulation of credit, labor, and business (column [2]). Especially, in this context, property rights are expected to be important (Johnson et al., 2002). In column (3) we reestimate column (2) without investments, an important channel for institutional quality. And, lastly, in column (4) of Table 3, we look at an institutional quality indicator from the ICRG, namely, socioeconomic conditions.

First we see that our estimations remain robust to a change in the institutions index in column (1). This index excludes the size of government score, which comprises, among others, tax rates. Next, by focusing on the aspects of institutions promoting the growth of the modern sector (column [2]), that is, secure property rights and the regulation of credit, labor, and business, which are more direct from a theoretical perspective, we still estimate a significant coefficient as expected. However, this result is not strengthened when we leave out investments (column [3]). The latter result is somewhat surprising as property rights are especially associated with the growth of the modern sector via enhancing the investment environment. A reconciling aspect might be that we capture the investment level with a very broad indicator. The last column (4) shows that the institutional quality indicator from the ICRG is similarly positively and significantly associated with the growth of the modern sector. Further the effects of our included control variables (especially official development aid and mineral resource rents) do not change in this extension.

TABLE 3 Manufacturing growth in developing countries—different institutions

Dependent: Manufacturing growth	Fraser			ICRG	
	No GS	PR and BR	PR and BR	Soc Econ	
	(1)	(2)	(3)	(4)	
Initial manufacturing <sub><i>t</i>-1</sub>	-0.201*** (0.056)	-0.596*** (0.147)	0.763*** (0.055)	-0.422*** (0.048)	
Manuf. exports <sub><i>t</i></sub>	0.119*** (0.039)	0.198*** (0.071)	0.062*** (0.021)	0.092*** (0.028)	
Institutions [2–5] <sub><i>t</i></sub>	0.051** (0.020)				
Institutions [2+5] <sub><i>t</i></sub>		0.075*** (0.028)	0.062** (0.028)		
Soc Econ <sub><i>t</i></sub>				0.050** (0.021)	
Schooling <sub><i>t</i></sub>	0.009 (0.022)	-0.000 (0.016)	0.001 (0.016)	0.002 (0.015)	
Urbanization <sub><i>t</i></sub>	0.000 (0.002)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	
Investments <sub><i>t</i></sub>	0.085* (0.048)	0.089* (0.053)			
ODA <sub><i>t</i></sub>	-0.044** (0.022)	-0.040* (0.021)	-0.037* (0.023)	-0.042** (0.017)	
Mineral res. rents <sub><i>t</i></sub>	-0.013*** (0.003)	-0.015*** (0.004)	-0.015*** (0.005)	-0.013** (0.007)	
Implied $\lambda$	0.049	0.051	0.052	0.045	
Observations	266	269	269	245	

(Continues)



**TABLE 3** (Continued)

Dependent: Manufacturing growth	Fraser			ICRG	
	No GS	PR and BR	PR and BR	Soc Econ	
	(1)	(2)	(3)	(4)	
Countries	70	71	71	66	
Hansen ( <i>p</i> -value)	0.27	0.46	0.47	0.18	
Diff-in-Hansen ( <i>p</i> -value)	0.22	0.64	0.84	0.24	
Instruments	69	69	63	52	
AR(1) ( <i>p</i> -value)	0.00	0.00	0.00	0.00	
AR(2) ( <i>p</i> -value)	0.33	0.37	0.33	0.22	

Notes: (see Table 1) Subcomponents of institutions index: Government size (GS 1), property rights (PR 2), access to money (3), freedom to trade (4), and business regulation (BR 5). \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively.

**TABLE 4** Manufacturing growth in developing countries—income interactions

<b>Dependent: Manufacturing growth model:</b>	<b>1st Quintile</b>	<b>2nd Quintile</b>	<b>3rd Quintile</b>	<b>4th Quintile</b>	<b>5th Quintile</b>
Initial manufacturing <sub><i>t</i>-1</sub>	-0.277*** (0.056)	-0.268*** (0.068)	-0.276*** (0.076)	-0.247*** (0.057)	-0.267*** (0.066)
Manuf. exports <sub><i>t</i></sub>	0.122*** (0.035)	0.124*** (0.042)	0.104** (0.048)	0.093** (0.046)	0.105*** (0.040)
Exports <sub><i>t</i></sub> × Inc1	-0.102*** (0.039)				
Exports <sub><i>t</i></sub> × Inc2	0.005 (0.017)				
Exports <sub><i>t</i></sub> × Inc3	-0.001 (0.009)				
Exports <sub><i>t</i></sub> × Inc4	0.013 (0.014)				
Exports <sub><i>t</i></sub> × Inc5	-0.002 (0.014)				
Institutions <sub><i>t</i></sub> [All]	0.080*** (0.030)	0.077** (0.032)	0.099*** (0.026)	0.105*** (0.026)	0.109*** (0.032)
Schooling <sub><i>t</i></sub>	-0.000 (0.014)	-0.007 (0.015)	0.000 (0.022)	-0.007 (0.018)	0.006 (0.012)
Urbanization <sub><i>t</i></sub>	0.002 (0.002)	0.002 (0.003)	0.002 (0.003)	0.001 (0.002)	0.001 (0.002)
Investments <sub><i>t</i></sub>	0.060 (0.047)	0.098 (0.060)	0.102* (0.060)	0.108* (0.056)	0.097 (0.062)
ODA <sub><i>t</i></sub>	-0.039* (0.022)	-0.043** (0.021)	-0.047** (0.023)	-0.050** (0.021)	-0.054*** (0.021)
Mineral res. rents <sub><i>t</i></sub>	-0.013*** (0.004)	-0.016*** (0.005)	-0.013** (0.005)	-0.013*** (0.004)	-0.014*** (0.005)
Implied $\lambda$	0.065	0.062	0.065	0.057	0.062
Observations	279	279	279	279	279
Countries	71	71	71	71	71
Hansen ( <i>p</i> -value)	0.50	0.51	0.43	0.52	0.53
Diff-in-Hansen ( <i>p</i> -value)	0.65	1.00	0.74	0.52	0.68
Instruments	69	69	69	69	69
AR(1) ( <i>p</i> -value)	0.00	0.00	0.00	0.00	0.00
AR(2) ( <i>p</i> -value)	0.34	0.37	0.42	0.40	0.41

Notes: (see Table 1). \*, \*\*, and \*\*\* denote significance at the 10%, 5%, and 1% level, respectively.

Next, we estimate our core model and interact our trade variable with dummies for different income levels in the countries under investigation. We propose and perform this exercise to evaluate whether our effects are robust across this dimension and whether policy implications can be

generated across the board for different levels of income. We generate quintile dummies according to the income at the end of the sample. In Table 4 we see evidence that the impact of trade levels may well be connected to the income group. While the interaction with higher-income levels generates the previously found evidence of a positive impact, the first quintile does not suggest a significant impact of trade levels on the growth of the modern sector. The quintile-specific results are derived from the joint validity of the two export coefficients.<sup>20</sup> We get the strong impression that countries at the lower end of the income scale have not been able to boost the growth of the modern sector through trading over the time frame studied. Because trade levels are comparatively low in the lowest-income group, we could argue that we are experiencing size effects, meaning that the volume of trade is not large enough to make an impact. Though this seems plausible when we look at the levels, there is another possible explanation. As prior literature has shown, diversification of exports (e.g., Berg et al., 2012) is beneficial as it insures against drawbacks in specific industries. We calculate the Herfindahl diversification index across income groups and find that the lowest-income group is least diversified in its manufacturing exports. We may thus argue that the lack of diversification also plays a role in the relationship between trade levels and the growth of the modern sector (cf. Table A1 [Appendix])

## 4 | CONCLUSION

In this contribution we study the determinants of the development of the modern sector and contribute to the recently revived interest in the development of the modern sector (e.g., Rodrik, 2013). We take the growth of the manufacturing sector as a broader indication for the economic modernization process in a developing country and ask for the determinants of this economic modernization process. What are the drivers for growth and diffusion of modern sector production within the developing society? Our modern sector perspective shall capture its role in long-run development and the sector as a source to provide fundamental societal and economic change on a potential path toward higher stages of development and income. Given the history of developed countries, we technically focus on the drivers of the growth of the manufacturing sector, namely, trade and institutional quality. In a cross section time-series analysis, we use several model specifications as well as several panel estimators to obtain robust results and account for potential econometric drawbacks, especially endogeneity. In our sample of 75 developing countries from all developing regions of the world, we find that both exports and institutional quality impacted on the growth of the manufacturing sector over the sample period 1970 to 2005.

Our results for manufacturing exports indicate that the diffusion of a country's modern production capacity is positively driven by exporting to international markets. One possible reason is that developing countries can bridge domestic demand shortages for manufacturing products by selling to the large global market. However, productivity and spillover gains are also likely induced by exposure to international competition. Next, we find that the aforementioned positive impact is not uniform across income levels. The poorest countries in our sample do not benefit from trade, possibly due to their negligible trade volumes that have no measurable impacts on the entire sector. In addition to low export levels, these countries are the least diversified.

Similarly, we find that the quality of overall institutions is beneficial for the development of the manufacturing sector. Our measure of institutional quality comprises several dimensions, including secure property rights, a dimension hypothesized as being especially important for capital-intensive manufacturing. Looking at this dimension more in isolation, we find evidence that this aspect is important, too, to the development of the modern sector.

Further, we find interesting results for our control variables. These include a negative impact of official development assistance on the development of the modern sector. That said, natural resources generally do not seem to weaken a country's likelihood of developing a successful modern sector. However, this latter result is conditional on factors such as institutions or exports. Finally, our isolated analysis of mineral resources indicates that their presence has a negative impact on the modern sector, giving rise to the assumption that the mineral sector impacts via a different channel than other resources. We propose that it is a labor-intense sector that absorbs human capital that would be needed to form the manufacturing sector.

The implications of our results are twofold. First, even though trade, in general, may not be found to be unambiguously positive for the overall growth, we provide evidence that, when it comes to the modern sector, exports appear to be a largely important source of growth. Thus, to enlarge the modern sector, there need to be adequate export opportunities for its products. And, second, we also find that sound (economic) institutions, especially secure property rights, are vital to this sector. However, since we do not find that exports are relevant in countries with very low income levels, further research is required to gain insights into how to encourage the growth of the manufacturing sector in least developed countries.

## ACKNOWLEDGMENTS

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## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in World Bank's World Development Indicators at <https://databank.worldbank.org/reports.aspx?source=world-development-indicators>;

Barro, R. J., & Lee, J.-W. (2010). *A new data set of educational attainment in the world, 1950–2010* (National Bureau of Economic Research Working Paper Series, No. 15902). Retrieved from <http://www.nber.org/papers/w15902>;

UN Comtrade at <https://comtrade.un.org/db/default.aspx>;

University of Groningen Penn World Table at <https://www.rug.nl/ggdc/productivity/pwt/pwt-releases/pwt8.0>, reference number PWT 8.0;

Fraser's Institute World Freedom Index at <https://www.fraserinstitute.org/economic-freedom/dataset?geozone=world&min-year=2&max-year=0&filter=0&page=dataset>;

International Country Risk Guide at <https://epub.prsgroup.com/products/icrg/international-country-risk-guide-icrg#>; University of Groningen Research Database at [https://www.rug.nl/research/portals/datasets/ggdc-10sector-database\(8e8fcc0d-3c13-424a-88be-7b87a31672fd\).html](https://www.rug.nl/research/portals/datasets/ggdc-10sector-database(8e8fcc0d-3c13-424a-88be-7b87a31672fd).html), reference number GGDC 10-Sector Database

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## ENDNOTES

<sup>1</sup> Throughout we focus on the whole manufacturing sector and term it 'modern' especially vis-à-vis a traditional agricultural sector in developing countries. A further refinement of subsectoral activity is not the subject of this article and would greatly alter data requirements.

- <sup>2</sup> This literature focuses on the impact of the modern (manufacturing) sector growth on the overall growth but (mostly) also acknowledges that, for example, a service sector can play an important role in development (see, e.g., Szirmai & Verspagen, 2011). However, as documented in De Vries et al. (2015), the service sector's productivity gains can mostly not match those of the manufacturing sector.
- <sup>3</sup> Similarly, Gollin et al. (2014) document a striking difference in productivity between the agricultural and non-agricultural sectors in developing countries. This may imply a misallocation of production factors that, if changed, bears a great potential for development.
- <sup>4</sup> Important also for later developing a high-productivity service sector. It is well known that in absolute size the manufacturing sector has often not exceeded 20% of the output.
- <sup>5</sup> See, for example, Dollar and Kraay (2003), Frankel and Romer (1999), or Wacziarg (2001) for a positive account of the impact of trade on growth, and Rodriguez and Rodrik (2001) for a critical account.
- <sup>6</sup> Imbs and Wacziarg (2003) find that along with the development level diversification first increases and later decreases again.
- <sup>7</sup> See Table A2 for a complete list.
- <sup>8</sup> The estimator is implemented in Stata in the routine `xtlsdvc`. We use the Blundell–Bond estimator for the initial estimates, apply a bias correction of order  $O(1/NT^2)$ , and use 200 repetitions to bootstrap the variance–covariance matrix. However, estimates do not change when we change these settings.
- <sup>9</sup> Examples of both may be found in Greenaway et al. (2007).
- <sup>10</sup> We use all available lags and collapse the instrument matrix only for those potentially endogenous variables that are not at the core of the analysis. We do so to maintain a maximum of information in the estimation.
- <sup>11</sup> As this is most crucial in system GMM estimation, we report this diagnostic right within the estimation results. However, all other subsets of our instruments pass the difference-in-Hansen test of instrument exogeneity (available upon request).
- <sup>12</sup> Upper middle-income countries, lower middle-income countries, and low-income countries with 2011 per-capita GNI of US\$4,036–12,475, US\$1,026–4,036, and < US\$1,025, respectively (for a list see Table A2 [Appendix]).
- <sup>13</sup> In (unreported) extensions we, therefore, also scale with GDP and see no contradictions with our core results. Similarly, when taking out scale parameters, the results are maintained. The use of the sectoral labor force's productivity greatly reduces the sample size and maintains results for exports.
- <sup>14</sup> For brevity we do not show the results for other subcomponents of natural resources. They are similar to the composite indicator in column (4). However, mineral rents, which appear significant, are maintained throughout the following estimations.
- <sup>15</sup> In fact, this finding is in line with the work of Pritchett (2001), who notes that the link may be weak, especially in macroestimations as ours.
- <sup>16</sup> The use of other approximations for available human capital (e.g., secondary schooling in the labor force, secondary schooling, primary schooling [all World Bank 2012]) does not change our results.
- <sup>17</sup> See, for example, van der Ploeg (2011), for a detailed discussion of channels through which natural resources impact on growth.
- <sup>18</sup> For more details on convergence, see, for example, Barro and Sala-i-Martin (2003).
- <sup>19</sup> See Rodrik (2013), p. 176, table 1, even-numbered columns.
- <sup>20</sup> By including one dummy at a time into the model, we strengthen interpretability and mitigate the risk of (perfect) multicollinearity issues.

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## APPENDIX

TABLE A1 Summary Statistics

Variable	Mean	Std.Dev.	Min.	Max.	N
Manuf. Growth	0.08	0.276	-1.326	1.151	517
Manuf. Output pc	217.99	267.775	3.564	1699.99	651
Manuf. Exports pc	122.086	285.535	0.031	3544.31	479
Institutions	5.452	1.15	2	7.9	498
Schooling (Years)	5.28	2.531	0.088	10.982	672
ODA pc	120.911	308.743	-2.723	6869.789	863
Investment pc	915.185	1068.276	11.838	7547.74	882
Urbanization (%)	40.005	19.932	2.884	91.685	956
Mineral rents (% of GDP)	1.111	3.135	0	23.934	817
<b>Manuf. Exports pc by group</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>	
Inc group 1	7.272	16.61	0.031	83.917	
Inc group 2	27.241	35.938	0.439	212.646	
Inc group 3	67.957	85.466	0.398	394.425	
Inc group 4	175.436	271.405	1.173	1585.311	
Inc group 5	303.74	491.405	4.61	3544.31	
<b>Export diversification by group</b>	<b>Herfindahl-Index for SITC 5 - 8</b>				
Inc group 1	0.358	0.253	0.031	0.985	
Inc group 2	0.338	0.227	0.03	0.985	
Inc group 3	0.315	0.24	0.013	0.986	
Inc group 4	0.192	0.17	0.003	0.826	
Inc group 5	0.301	0.22	0.012	0.881	

TABLE A2 Countries included

Algeria, Argentina, Armenia, Benin, Bangladesh, Bulgaria, Belize, Bolivia, Brazil, Botswana, Central African Republic, Chile, China, Cote d'Ivoire, Cameroon, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, Fiji, Gabon, Guatemala, Guyana, Honduras, Indonesia, India, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kyrgyz Republic, Sri Lanka, Lesotho, Lithuania, Morocco, Moldova, Mexico, Mali, Mongolia, Mozambique, Mauritius, Malawi, Malaysia, Namibia, Niger, Nicaragua, Nepal, Pakistan, Panama, Peru, Philippines, Papua New Guinea, Paraguay, Rwanda, Senegal, El Salvador, Togo, Thailand, Tunisia, Turkey, Tanzania, Uganda, Ukraine, Uruguay, Venezuela, Vietnam, South Africa, Zambia, Zimbabwe